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ARTICLE

Towards a Transnational Approach to Transboundary Haze Pollution: Governing Traditional Farming in Fire-Prone Regions of Indonesia

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Abstract
In Indonesia, swidden practices have been part of traditional rice farming for centuries. Swidden agriculture is a fundamental part of all remaining large tropical forests and provides a critical form of biodiversity-friendly agriculture. Meanwhile, peatland degradation and land conversion for oil palm plantation and agriculture have created an annual transboundary environmental disaster in Southeast Asia. This article adopts a transnational lens to highlight the complex multi-scale interactions that perpetuate recurring transboundary air pollution in the region. Having examined the traditional practices of swidden agriculture in Central Kalimantan and South Sumatra (Indonesia), the article reveals that swidden agriculture has been misunderstood generally, and in particular in international and national law and policy. It argues that existing laws fail to identify the important role that swidden agriculture plays in sustainable ecosystem management and cultural expression. Nuanced understandings of fire use, alongside transnational multi-stakeholder and multi-scale approaches, are required.

Keywords: Traditional ecological knowledge, Swidden agriculture, Transboundary haze, Peatland restoration, Multi-stakeholder platform, Transnational governance

1. INTRODUCTION

Swidden agriculture has been practised across Indonesia for generations. The term, used interchangeably with 'shifting cultivation', refers to a rotational agricultural system whereby land used for farming is allowed to regenerate through a fallow phase. In swidden agriculture, the fallow phase (where crops are not grown) is sufficiently long that woody

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vegetation can dominate the area. This vegetation is then removed using fire.[1] In Indonesia, swidden practices have been part of traditional rice farming for centuries[2] – rice being a key food staple in the region. Swidden agriculture is a fundamental part of all remaining large tropical forests and provides a critical form of biodiversity-friendly agriculture.[3] Yet, swidden agriculture has been 'criticized, condemned, and criminalized everywhere it exists' as the complexity of traditional swidden approaches runs counter to 'modern' forms of agriculture, which are founded on ease of harvesting, monitoring, and measurement.[4] Consequently, reflecting global trends, there has been a drastic decrease in the practice.[5]

Peatlands are a unique ecosystem that are of utmost importance for maintaining biodiversity at many different levels, including genetic, species, and broader habitat diversity.[6] Peatlands are also water catchments which modify the quality and quantity of water supplies, including that supplied to rivers and lakes.[7] This ecosystem is also a critical carbon sink. The burning of degraded peatlands in Indonesia is a significant source of greenhouse gas emissions, which exacerbates global climate change.[8] The denigration of swidden agriculture practices is particularly pronounced in a context where transboundary haze remains an annual threat across Southeast Asia. Peat fires in Indonesia are widely recognized as the main source of severe air pollution across the region.[9] Peatland degradation and conversion for oil palm plantations and agriculture, and the fire risk that results, have created a transboundary environmental disaster in Southeast Asia. The worst forest fires occurred in 1997, 2006, 2009, 2012, 2013, 2015 and 2019. The 2015 fires devastated seven Indonesian provinces and destroyed approximately 600,000 hectares of peatland.[10] Nevertheless, traditional swidden practices remain the approach preferred by local communities for clearing peatland for agriculture. Fire is widely recognized by locals to increase crop yields by increasing the fertility of the region's acidic soils.[11] Yet, as a response to the 2015 fires, a zero-burning policy has been

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1 O. Mertz et al., 'Swidden Change in Southeast Asia: Understanding Causes and Consequences' (2009) 37(3) *Human Ecology*, pp. 259–64; P.H. Thung, 'A Case Study on the Persistence of Swidden Agriculture in the Context of Post-2015 Anti-Haze Regulation in West-Kalimantan' (2018) 46(2) *Human Ecology*, pp. 197–205, at 197.

2 M. Siahaya et al., 'Traditional Ecological Knowledge on Shifting Cultivation and Forest Management in East Borneo, Indonesia' (2016) 12(1–2) *International Journal of Biodiversity Science, Ecosystem Services & Management*, pp. 14–23, at 19.

3 C. Padoch & M. Pinedo-Vasquez, 'Saving Slash-and-Burn to Save Biodiversity' (2010) 42(5) *Biotropica*, pp. 550–2, at 551.

4 Ibid.

5 Ibid.; Thung, n. 1 above, p. 199.

6 D. Clarke & J.O. Rieley, *Strategy for Responsible Peatland Management*, 6th edn (International Peatland Society, 2019).

7 J. Xu et al., 'Hotspots of Peatland-Derived Potable Water Use Identified by Global Analysis' (2018) 1(5) *Nature Sustainability*, pp. 246–53.

8 R. Vasquez et al., 'Estimating Greenhouse Gas Emissions from Peat Combustion in Wildfires on Indonesian Peatlands, and their Uncertainty' (2021) 35(2) *Global Biogeochemical Cycles*, pp. 1–17, at 2.

9 H. Hayasaka & A. Sepriando, 'Severe Air Pollution Due to Peat Fires during 2015 Super El Niño in Central Kalimantan, Indonesia', in K. Vadrevu, T. Ohara & C. Justice (eds), *Land-Atmospheric Research Applications in South and Southeast Asia* (Springer, 2018), pp. 129–42, at 130.

10 'Lebih dari 2 juta Hektar Lahan di Indonesia terbakar tahun ini', *Rappler*, 30 Oct. 2015, available at: https://www.rappler.com/indonesia/111232-dua-juta-hektar-lahan-indonesia-terbakar-tahun-ini.

11 Thung, n. 1 above, p. 199.

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enforced against traditional farmers in peatland areas with alternative clearing methods being used in fire-prone parts of Central Kalimantan and South Sumatra.[12]

There exists a considerable body of scholarship that examines regional, transboundary,[13] and national[14] governance approaches to haze pollution across the region. However, the current legal and policy frameworks have not considered meaningfully how to centre Indigenous and local communities and promote more equitable peatland management from a transnational law perspective. Yet, there are increasing calls to centre Indigenous and local communities in sustainability decision making to 'live in harmony with nature'.[15] This article seeks to address this gap through the following research question. How can a transnational law approach address transboundary haze pollution and sustainable peatland management in Indonesia in a culturally appropriate way across a changing landscape?

The article argues that existing laws fail to identify the important role that swidden agriculture plays in sustainable ecosystem management. Nuanced understandings of fire use are required alongside a transnational multi-stakeholder and multi-scale approach. The article contends that swidden agriculture has been misunderstood generally, and in particular in international and national law and policy frameworks. It adopts a transnational lens to highlight the complex multi-scale interactions which perpetuate the recurring international environmental crisis of transboundary air pollution. A transnational lens is extended to examine the law and policy that govern traditional burning and its implications across multiple governance scales. The article focuses on the traditional practices of swidden agriculture in Central Kalimantan and South Sumatra (Indonesia).

In Section 2, the article establishes the transdisciplinary methodology that has been adopted for this research. Section 3 discusses traditional burning ('swidden') practices in Indonesia. Section 4 then examines the interaction of transnational law with traditional burning techniques which have a significant impact on local communities. This analysis involves an examination of Indonesia's international law obligations regarding Indigenous communities and traditional knowledge, obligations to prevent

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[12] S. Alam & L. Nurhidayah, 'The International Law on Transboundary Haze Pollution: What We Can Learn from the Southeast Asia Region' (2017) 26(3) *Review of European, Comparative and International Environmental Law*, pp. 243–54, at 253.

[13] Ibid.

[14] L. Nurhidayah, 'Legislation, Regulations, and Policies in Indonesia Relevant to Addressing Land/Forest Fires and Transboundary Haze Pollution: A Critical Evaluation' (2013) 16(1) *Asia Pacific Journal of Environmental Law*, pp. 215–36, at 215.

[15] E.S. Brondézio et al., 'Assessing a Planet in Transformation: Rationale and Approach of the IPBES Global Assessment on Biodiversity and Ecosystem Service', in E.S. Brondízio et al., *Global Assessment Report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services* (IPBES Secretariat, 2019), pp. 1–48, at 11, available at: https://doi.org/10.5281/zenodo.3831673; M. Lim, 'Biodiversity 2050: Can the Convention on Biological Diversity Deliver a World Living in Harmony with Nature?' (2021) 30(1) *Yearbook of International Environmental Law*, pp. 79–101. Decision X/2, 'The Strategic Plan for Biodiversity 2011–2020 and the Aichi Biodiversity Targets' (18–29 Oct. 2010) of the 10th Conference of the Parties to the Convention on Biological Diversity (CBD) adopted the 2050 vision of the CBD, which aims to achieve, by 2050, a world 'living in harmony with nature'. This vision also informs current negotiations towards the post-2020 framework of the CBD (Rio de Janeiro (Brazil), 5 June 1992, in force 29 Dec. 1993, available at: http://www.cbd.int/convention).

transboundary harm and carbon emissions, including those imposed by the Association of Southeast Asian Nations (ASEAN) Agreement on Transboundary Haze Pollution[16] and local regulations. This section also sets out how international law is incorporated in the domestic context in Indonesia and examines how national laws seek to address and implement international obligations. Section 5, through two case studies from Central Kalimantan and South Sumatra, evaluates the governance structures within Indonesia that implement these international obligations. As this article shows, these obligations fail to recognize the nuances inherent in swidden agriculture: namely, its importance in providing essential ecosystem services, livelihoods, and cultural expression for Indigenous communities. In Section 6, the article addresses the challenges and opportunities for transnational collaboration for equitable and sustainable peatland governance. Section 7 concludes.

2. METHODOLOGY

A transnational law lens – which embraces both formal and traditional rules, from local to international state and non-state actors[17] – is critical for effective peatland management that prevents transboundary harm. In the context of peatland management, Van der Ploeg and Persoon highlight that effective natural resource management must embrace local practices such as swidden agriculture to gain a deeper understanding of why such practices continue to perpetuate despite what is stipulated under the law.[18] As such, a purely doctrinal approach which evaluates existing laws remains insufficient. This article adopts an interdisciplinary approach within an overall strategy of triangulation, a methodology that uses multiple methods to view an issue from a range of perspectives to develop a holistic understanding of the phenomenon under investigation.[19]

This research involves desk-based analysis of local regulations, national law, regional agreements, and international environmental law which is grounded in an empirical case study of the most fire-prone regions of Indonesia: Central Kalimantan and South Sumatra. Central Kalimantan has been chosen as a case study as it is inhabited by the Indigenous Dayak communities who engage in swidden agriculture in peatland areas. These practices have previously been accommodated in local regulations. The main interview sites were the Central Kalimantan province, especially in the Pulang Pisau[20] and Kapuas regencies, where forest fires occur annually. Focus group discussions with

[16] Kuala Lumpur (Malaysia), 10 June 2002, in force 25 Nov. 2003, available at: https://asean.org/wp-content/uploads/2021/01/ASEANAgreementonTransboundaryHazePollution-1.pdf.

[17] L. Kotzé & C. Soyapi, 'Transnational Environmental Law: The Birth of a Contemporary Analytical Perspective', in D. Fisher (ed.), *Research Handbook on Fundamental Concepts of Environmental Law* (Edward Elgar, 2016), pp. 82–110.

[18] J. van der Ploeg & G. Persoon, 'Figments of Fire and Forest: Shifting Cultivation Policy in the Philippines and Indonesia', in M.F. Cairns (ed.), *Shifting Cultivation Policies: Balancing Environmental and Social Sustainability* (Centre for Agriculture and Bioscience International (CABI), 2017), pp. 57–80, at 75.

[19] N. Denzin, *The Research Act: A Theoretical Introduction to Sociological Methods* (Prentice Hall, 1989); W. Olsen, 'Triangulation in Social Research: Qualitative and Quantitative Methods Can Really Be Mixed', in M. Holborn (ed.), *Developments in Sociology* (Causeway Press, 2004), pp. 103–18, at 103.

[20] In Indonesia, a 'regency' (*kabupaten*) refers to the administrative division directly below a province and above a district.

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communities were also conducted in the Kapuas regency of Anjir Kalampan village. South Sumatra was chosen as the second case study, with interviews conducted in the Ogan Komering Ilir regency. The region is renowned for its traditional *sonor* burning practices where local farmers use fire to open rice fields and farmland in peatland areas. In each of the case studies, interviews were conducted with key stakeholders such as farmers, heads of villages, local government officials, and non-governmental organizations (NGOs). Data collected through interviews focused on stakeholder perspective on traditional practices of peatland management, the traditional practices of using fires, and the impacts of government peatland restoration policy on traditional farmers. The empirical studies facilitated an on-the-ground understanding of the implications of each legal and administrative layer of the transnational issues discussed below.

2.1. *A Transnational Approach: Towards a Collaborative Environmental Governance*

A transnational environmental law approach widens the inquiry to include 'all environmental norms that apply to transboundary activities or that have effects in more than one jurisdiction'.[21] Transnational environmental law scholarship provides an analytical framework to consider the multi-dimensional impacts of broader environmental problems, and has a tradition of evaluating structures of environmental governance and their multi-layered manifestation in various environmental sectors.[22] Transnational environmental law 'recognizes that the state is but one of the many actors that ought to be involved in governing human actions *vis-à-vis* the environment. It also recognizes the important normative contributions made by non-state actors',[23] which include coalitions, corporations, banks, international donors, local and international NGOs, and community representatives.[24]

Top-down regulation still serves an important governance function. States aim to prevent transboundary haze pollution by imposing a zero-burning policy that is backed by the threat of prosecution. However, state-led approaches have important limitations.[25] Most notably, in the Indonesian context the effectiveness of state-led approaches in implementing a zero-burning policy is dependent on the sustained involvement of local communities in peatland restoration programmes, as well as the participation of civil society organizations, international donors, academics, and companies. As the adverse outcomes associated with haze pollution are transboundary in nature, a sound methodology must aspire to evaluate the performance of hybrid modes of governance, including the state, private, and societal actors and institutions across mixed landscapes and regulatory regimes.[26]

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[21] E. Webster & L. Mai, 'Transnational Environmental Law in the Anthropocene' (2020) 11(1) *Transnational Legal Theory*, pp 1–15.

[22] T.F.M. Etty et al., 'Broadening the Branches and Deepening the Roots of Transnational Environmental Law' (2021) 10(1) *Transnational Environmental Law*, pp, 1–11.

[23] Ibid.

[24] M.A. Miller et al., 'Hybrid Governance of Transboundary Commons: Insights from Southeast Asia' (2020) 110(1) *Annals of the American Association of Geographers*, pp. 297–313.

[25] Etty et al., n. 22 above.

[26] Miller et al., n. 24 above.

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The following section highlights the nuances of the complex multi-scale issues of forest fires and sustainable peatland management in Indonesia, and the critical need for integrated transnational governance approaches.

3. TRADITIONAL FARMING: THE USE OF FIRE IN SHIFTING CULTIVATION IN INDONESIA

Fire is a key ecological process that influences the distribution, structure, and functioning of many biomes worldwide.[27] In many traditional communities fire is associated with hunting, crop improvement, pest control, habitat diversity, range management, fireproofing, fuelwood, travel route maintenance, riparian area clearing, the growing of basket materials, communication, and ceremonies.[28] Fire has a key role in swidden agriculture, with local people influencing fire regimes by affecting when, where, and how fires burn. This form of agriculture uses fire as a central feature, which maintains the world's remaining large tropical forests from Amazonia, to Central Africa, to Borneo.[29]

Swidden agriculture has been a key part of upland Southeast Asian food systems for centuries, particularly for the growth of upland rice.[30] Traditional knowledge plays a key role in swidden agriculture in the region. Within the Dayak communities of Kalimantan, swidden agriculture is adopted as a wide-ranging strategy for maintaining healthy soil fertility while protecting insects, fish, amphibians, and other animals. Here, spirit ancestors are drawn on as guides throughout the process.[31] Traditional knowledge informs the selection of appropriate cultivation plots, determining the suitability of the soils, the time of year when each stage is implemented, and drawing on culturally determined 'signs of nature'.[32]

Swidden agriculture is increasingly recognized as an important form of biodiversity-friendly agriculture.[33] Traditional swidden agriculture in Indonesia, reflecting practices globally,[34] facilitates significant biological and nutritional diversity. In Indonesia, rice is intercropped with other foods.[35] While this process may not lend itself easily to the intensification of 'modern' agricultural practices, it performs highly favourably in terms of dietary variety and quality.[36] The genetic diversity of the crop also plays a key role in food security. However, despite the use of such practices dating back millennia, the

[27] W.J. Bond & J.E. Keely, 'Fire as a Global "Herbivore": The Ecology and Evolution of Flammable Ecosystems' (2005) 20(7) *Trends in Ecology and Evolution*, pp. 387–94, at 387.

[28] F.K. Lake et al., 'Returning Fire to the Land: Celebrating Traditional Knowledge and Fire' (2017) 115(5) *Journal of Forestry*, pp. 343–53.

[29] Padoch & Pinedo-Vasquez, n. 3 above, p. 551. Central Kalimantan in Indonesia Borneo is one of the case studies examined in this article.

[30] Siahaya et al., n. 2 above, p. 19.

[31] Ibid.

[32] Ibid.

[33] Padoch & Pinedo-Vasquez, n. 3 above.

[34] Ibid.

[35] Siahaya et al., n. 2 above.

[36] Padoch & Pinedo-Vasquez, n. 3 above.

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practice is rapidly disappearing in Indonesia. This decline reflects global trends and is the result of swidden agriculture being maligned, on the one hand, by national governments and, on the other, not being sufficiently embraced by younger generations within traditional communities.[37] The decline and active discouragement of swidden agriculture has significant implications for the wellbeing of swidden farmers.[38] In the specific context of the Dayak community of Kalimantan, the Dayak identity is recognized as being closely connected with traditional farming activities. Ending these farming practices would result in the communities being disconnected from their ancestral roots.[39]

Traditional swidden agriculture practices, especially in peatland areas, have been characterized as unsustainable and not conducive to large-scale food production.[40] This characterization continues in Indonesian law and policy. For example, the Mega Rice Project (MRP) programme has resulted in significant deforestation with approximately 45,000 square kilometres (km^2) of peat being dug up to a depth of more than three metres for the MRP canals, which has contributed to fire-related air pollution.[41] Page and her co-authors suggest that while the government is vocal about its intentions to reduce and combat forest fires, many of its policies, such as the MRP and oil palm expansion, have contributed to increased fire frequency.[42] Furthermore, from an ecological perspective, the recommended peat depth for rice cultivation is shallow peat (less than one metre) as it poses a lower environmental risk and has a relatively higher fertility rate.[43] Local communities who practise swidden agriculture emphasize the importance of not mischaracterizing their traditional burning practices as being akin to the widespread burning to clear land for oil palm plantations.[44] In pre-disturbance landscapes with small human populations, there was limited risk of accidental ignitions or fire spread as the landscape was resistant to fire.[45] Concerns have therefore been raised that *any* form of burning in peatland areas might exacerbate the risk of fire.[46]

Local communities contend that corporations and large-scale oil palm plantations are mainly responsible for the widespread land and forest fires. Traditional swidden farmers emphasize the differences between traditional burning and the widespread

[37] Ibid.; Thung, n. 1 above.

[38] Thung, n. 1 above.

[39] Siahaya et al., n. 2 above (citing A.M.Z. Widjono & R. Haryo, *Masyarakat Dayak Menatap Hari Esok* (Gramedia Widiasarana, 1988)).

[40] P.J.A Kleinman, D. Pimentel & R.B. Bryant, 'The Ecological Sustainability of Slash and Burn Agriculture' (1995) 52(2–3) *Ecosystem and Environment*, pp. 235–49, at 235.

[41] H. Hayasaka et al., 'Peat-fire-related Air Pollution in Central Kalimantan, Indonesia' (2014) 95 *Environmental Pollution*, pp. 1–10.

[42] S. Page et al., 'Restoration Ecology of Lowland Tropical Peatlands in Southeast Asia: Current Knowledge and Future Research Direction' (2008) 12(6) *Ecosystem*, pp. 888–905.

[43] E.N. Nirmala Sari, 'Opportunities and Challenges for Sustainable Rice Agriculture on Peatlands', WRI Indonesia, 23 June 2020, available at: https://wri-indonesia.org/en/blog/opportunities-and-challenges-sustainable-rice-agriculture-peatlands.

[44] Thung, n. 1 above; Siahaya et al., n. 2 above.

[45] S.E Page & A. Hooijer, 'In the Line of Fire: The Peatlands of Southeast Asia' (2016) 371(1969) *Philosophical Transactions of the Royal Society B*, pp. 1–9, at 5.

[46] Ibid.

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slash and burn carried out by corporate oil palm plantations.[47] Traditional techniques adhere to long fallow periods. The literature suggests that this form of agriculture provides important contributions to food security while not contributing to long-term deforestation.[48] That said, the degraded nature of the contemporary peatland ecosystem makes it increasingly prone to fire.[49] Nevertheless, the Indonesian government has failed to hold corporations responsible for the large-scale peat fires. Communities point out that local and foreign plantation companies have cultivated strong patronage linkages with key patrons among the ruling elite.[50] During the land and forest fires in 2015, 23 companies were penalized for causing these fires.[51] The sanctions ranged from administrative sanctions to the revocation of licences.[52] The fires of 2015 and the adoption of the ASEAN Agreement on Transboundary Haze Pollution[53] led to the Indonesian government applying a zero-burning policy not only to all corporations but also to local communities.[54]

The challenge for law and policy, therefore, is to differentiate between the types of burning that contribute to massive forest and peat fires with disastrous local and transboundary impacts, on the one hand, and traditional burning practices that are informed by traditional ecological knowledge developed over millennia, on the other hand. There is a need to understand the impact of all forms of fire on an increasingly changed and degraded landscape and what this means for regulation at multiple governance scales.

4. TRANSBOUNDARY HAZE POLLUTION REGULATION THROUGH A TRANSNATIONAL LAW LENS

Indonesia is home to approximately 1,331 ethnic groups.[55] Each possesses a rich heritage of cultural practices, languages, and traditional farming practices such as swidden agriculture. These practices are affected by laws, regulations, and policy from international, regional, and local jurisdictions, including transnational laws which regulate transboundary haze pollution and recognize Indigenous rights. This section examines the interplay of these different laws and policies to evaluate their impact on traditional swidden farming practices and sustainable peatland management.

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47 Thung, n. 1 above; Siahaya et al., n. 2 above.

48 W. Dressier et al., 'The Impact of Swidden Decline on Livelihoods and Ecosystem Services in Southeast Asia: A Review of the Evidence from 1990 to 2015' (2017) 46(3) *Ambio*, pp. 291–310.

49 Ibid.

50 H. Varkkey, 'Patronage Politics, Plantation Fires and Transboundary Haze' (2013) 12(3–4) *Environmental Hazards*, pp. 200–17.

51 'Indonesia Punishes 23 Companies for Starting Fires', *The Jakarta Post*, 23 Dec. 2015, available at: https://www.thejakartapost.com/news/2015/12/23/indonesia-punishes-23-companies-causing-forest-fires.html.

52 Ibid.

53 N. 16 above.

54 'Buka Kebun dengan Cara Membakar, Terancam 10 Tahun Penjara', *Dinas Perkebunan Provinsi Kalimantan Timur*, 15 Sept. 2015, available at: https://disbun.kaltimprov.go.id/artikel/buka-kebun-dengan-cara-membakar-terancam-10-tahun-penjara.

55 International Work Group for Indigenous Affairs (IWGIA), 'Indigenous Peoples in Indonesia', 2022, available at: https://www.iwgia.org/en/Indonesia.

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4.1. *International Law relating to Traditional Swidden Agricultural Methods*

Indigenous rights and the continuation of traditional cultural practices have long been recognized in international law. There are several key instruments which aim to preserve Indigenous rights and which have important roles in protecting swidden agricultural techniques as a legitimate form of sustainable peatland management. The United Nations (UN) Declaration on the Rights of Indigenous Peoples (UNDRIP)[56] is one such instrument. The UNDRIP endorses the rights of Indigenous peoples as a collective and as individual rights,[57] providing such communities with rights to self-determination, land rights, and cultural rights. Both the land and cultural rights provided by the UNDRIP are important, as domestic policy or legislation which aims to restrict traditional swidden agriculture techniques are vulnerable to compliance issues against the UNDRIP.

Under the UNDRIP, Indigenous peoples have the right to determine their own strategies for the development or use of their lands and other resources,[58] and to exercise their right to development.[59] Indigenous peoples also have the right to conserve and protect the productive capacity of their lands;[60] to own, use, and develop the lands and resources that they possess by reason of traditional ownership or other traditional occupation or use;[61] to maintain their political, economic and social systems to be secure in the enjoyment of their own means of subsistence;[62] and to practise their cultural traditions and customs.[63] The UNDRIP also contains several important provisions relating to governance that can enable enjoyment of Indigenous rights. These provisions include the requirement for states to consult with Indigenous peoples and obtain their free and informed consent prior to approving projects that may affect their lands and resources;[64] the right to redress where lands are occupied or used without their free, prior and informed consent;[65] and the requirement for states to establish fair, open, and impartial processes to recognize and adjudicate Indigenous land rights.[66] States are also required to consult and cooperate in good faith to obtain free, prior and informed consent before adopting legislative measures that may affect them.[67] This latter provision is vital for securing sufficient mechanisms to ensure that any prohibition of swidden agriculture is informed by adequate consultation and

[56] UN General Assembly, 'United Nations Declaration on the Rights of Indigenous Peoples', 13 Sept. 2007, UN Doc. A/RES/61/295, available at: https://www.un.org/development/desa/indigenouspeoples/declaration-on-the-rights-of-indigenous-peoples.html.

[57] Ibid., Art. 1.

[58] Ibid., Art. 32(1).

[59] Ibid., Art. 23.

[60] Ibid., Art. 29.

[61] Ibid., Art. 26(2).

[62] Ibid., Art. 19.

[63] Ibid., Art. 11.

[64] Ibid., Art. 32(2).

[65] Ibid., Art. 28.

[66] Ibid., Art. 27.

[67] Ibid., Art. 19.

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permission from Indigenous communities who practise this form of sustainable peatland management.

Obtaining free, prior and informed consent remains a vital aspect of peatland management, the absence of which can materially affect projects and regulations which aim to limit the exercise of customary Indigenous rights. In *Awas Tingni* v. *Nicaragua*, the Nicaraguan government determined that financial compensation should be provided for the Awas Tingni people for granting 63,000 hectares to a logging concession.[68] However, the response of the Nicaraguan government was inadequate throughout the consultation process. The Inter-American Court of Human Rights determined that the grant of logging concessions was inconsistent with the land rights held by the Awas Tingni people and violated their right to property.[69] This case established the collective land and resource rights held by Indigenous people, despite the lack of efforts by the state to recognize and realize these rights. In *Endorois Welfare Council* v. *Kenya*, the Endorois community was forcibly relocated away from Lake Bogoria to create a nature reserve. The community was not consulted during this process and had no access to benefit sharing or compensation. The African Commission on Human and Peoples' Rights determined that the Endorois community held ownership over its ancestral land, and had a right to development and to enjoy the community's natural resources.[70] This case demonstrates that Indigenous rights remain a relevant consideration even for conservation efforts.

The protection of traditional knowledge is also a key aspect of sustainable peatland management which is present in several contemporary environmental agreements. Under Article 8(j) of the Convention on Biological Diversity (CBD), states are required to 'respect, preserve and maintain' the use of traditional knowledge in conservation and sustainable resource use within the area of biological diversity, and to promote its wider application 'with the approval and involvement of the holders' of this knowledge.[71] The CBD also requires states to protect and encourage customary use of biological resources in accordance with traditional cultural practices,[72] with Article 15(5) requiring parties to obtain prior informed consent from Indigenous people where genetic resources are accessed. Article 17(2) also requires that the exchange of information – including Indigenous and traditional knowledge – be facilitated, with Article 18(4) requiring states to 'encourage and develop methods of cooperation for the development and use of … Indigenous and traditional technologies'.[73] The Rio Declaration has similarly recognized the important role of traditional knowledge, stating that 'Indigenous people and their communities, and other local communities, have a vital role in

[68] Inter-American Court of Human Rights, *The Mayagna (Sumo) Awas Tingni Community* v. *Nicaragua*, Judgment of 31 Aug. 2001, Series C No. 79 (2001).

[69] Ibid., para. 151.

[70] African Union, African Commission on Human and Peoples' Rights, *Centre for Minority Rights Development (Kenya) and Minority Rights Group International on behalf of Endorois Welfare Council* v. *Kenya*, Doc. No. 276/03, 27 AAR, 11–25 Nov. 2009, para. 175.

[71] N. 15 above.

[72] Ibid., Art. 10(c).

[73] Ibid.

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environmental management and development because of their knowledge and traditional practices'.[74] The Declaration further notes that '[s]tates should recognize and duly support their identity, culture and interests and enable their effective participation in the achievement of sustainable development'.[75] These provisions point to the central role that traditional knowledge plays in both achieving sustainable development and biological diversity.

The cultural and political rights enjoyed by Indigenous peoples are not unlimited and are bound by proportionality where there is a legitimate public policy objective. For example, the right to enjoy property free from interference is curtailed where an exercise of this right would interfere with the safety or enjoyment of another person's property and give rise to a claim in nuisance,[76] which is a relevant consideration given the extent to which swidden agriculture does create haze pollution and carbon emissions. The rationale for prohibiting the use of swidden agriculture may stem from aims to conserve the environment or to reduce carbon emissions. Nevertheless, such prohibitions must respect the collective and individual rights held by Indigenous communities and their ability to use swidden agriculture as a cultural custom and a means of subsistence. In addition, it is also important to recognize traditional swidden processes as a form of sustainable peatland management and, therefore, as a practice that is synergistic with environmental conservation and carbon sequestration goals.

Yet, despite the recognition of Indigenous cultural and proprietary rights, there has been limited integration of Indigenous needs in the growing body of climate change law. Climate change presents an existential threat to Indigenous and other agrarian communities, who are highly vulnerable to growing climate change impacts.[77] Meanwhile, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) Global Assessment found that lands governed by Indigenous peoples and local communities have significantly better biodiversity outcomes.[78] At the same time, the Report on Biodiversity and Climate Change co-sponsored by IPBES and the Intergovernmental Panel on Climate Change (IPCC) emphasizes the importance of maintaining intact ecosystems as a fundamental means of achieving co-benefits for biodiversity and carbon sequestration.[79] Thus, it is critical to recognize not only the

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[74] Report of the UN Conference on Environment and Development, Rio de Janeiro (Brazil), 3–14 June 1992, UN Doc. A/CONF.151/26/Rev.1, vol. I, Annex I, Principle 22, available at: https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_CONF.151_26_Vol.I_Declaration.pdf.

[75] Ibid.

[76] See K. Markey, 'Air Pollution as Public Nuisance: Comparing Modern-day Greenhouse Gas Abatement with Nineteenth Century Smoke Abatement' (2022) 120(7) *Michigan Law Review*, pp. 1535–69.

[77] H. Hapsari et al., 'Adaptation of Indigenous Community Agricultural Systems on Climate Change: Case Study of Kasepuhan Ciptagelar, Sukabumi Regency, West Java' (2019) 306(1) *IOP Conference Series: Earth and Environmental Science*, pp. 1–9; S. Anderson, J. Morton & C. Toulmin, 'Climate Change for Agrarian Societies in Drylands: Implications and Future Pathways', in R. Mearns & R. Norton (eds), *Social Dimensions of Climate Change: Equity and Vulnerability in a Warming World* (World Bank, 2009), pp. 199–230; M. Altieri et al., 'Agroecology and the Design of Climate Change-Resilient Farming Systems' (2015) 35(3) *Agronomy for Sustainable Development*, pp. 869–90.

[78] Brondizio et al., n. 15 above.

[79] H.O. Pörtner et al. (eds), *IPBES-IPCC Co-sponsored Workshop Report on Biodiversity and Climate Change*, (IPBES & IPCC, 2021).

impacts of biodiversity loss and climate change on Indigenous peoples and local communities but also to understand the important role of Indigenous knowledge and governance systems in addressing the impacts of global environmental change. To date, the global community has continued to push efforts to mitigate anthropogenic carbon emissions which contribute to climate change, including emissions associated with 'slash-and-burn' land-clearing techniques. In the latest Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC),[80] parties have committed to halt and reverse deforestation by 2030 and promote inclusive rural transformation.[81] Under these commitments, parties have pledged to conserve forests and other terrestrial ecosystems, noting the importance of recognizing Indigenous rights in accordance with national legislation and international instruments. It is the latter commitment which raises concerns as to whether Indigenous rights will be respected in domestic legislation.

4.2. *Regional Approaches: ASEAN Agreement on Transboundary Haze Pollution*

Indonesia ratified the ASEAN Agreement on Transboundary Haze Pollution (ASEAN Haze Agreement)[82] in September 2014.[83] This obliges the Indonesian government to increase the application and enforcement of strict domestic laws to prevent and control haze pollution resulting from land and forest fires. In Indonesia, a decision to implement the obligation not to cause transboundary environmental harm by way of suppressing the burning practices of Indigenous or traditional communities is to some extent in conflict with the recognition of controlled burning for shifting cultivators and small farmers within the Agreement.[84] The ASEAN Haze Agreement highlights the principles of prevention of transboundary haze, in particular, in Articles 4 and 9. These provisions require, inter alia, the exchange of information and technology, and the development and implementation of legislation and other regulatory measures at the state level to promote zero burning.

Importantly, the ASEAN Haze Agreement does recognize Indigenous knowledge and practices which can support fire prevention and management. Fire prevention and management refers to strengthening local fire management and firefighting capability and co-ordination to prevent the occurrence of land and/or forest fires, and promoting and utilizing Indigenous knowledge and practices in fire prevention and management.[85] In addition, the Haze Agreement calls for technical cooperation between ASEAN member states to promote the exchange of relevant information, expertise, technology,

[80] New York, NY (US), 9 May 1992, in force 21 Mar. 1994, available at: https://unfccc.int.

[81] See UN Climate Change Conference, United Kingdom, 2021, 'Glasgow Leaders' Declaration on Forests and Land Use', 2 Nov. 2021, available at: https://ukcop26.org/glasgow-leaders-declaration-on-forests-and-land-use.

[82] N. 16 above.

[83] L. Bell, 'After 12 Years Indonesia Finally Ratifies Transboundary Haze Agreement', *Mongabay*, 19 Sept. 2014, available at: https://news.mongabay.com/2014/09/after-12-years-indonesia-finally-ratifies-transboundary-haze-agreement.

[84] N. 16 above, Art. 16(1)(e).

[85] Ibid., Art. 9(f).

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techniques, and know-how. The Agreement itself accommodates some controlled burning practices, as stated in Article 16(1)(e): technical cooperation includes measures to '[d]evelop or establish techniques on controlled burning particularly for shifting cultivators and small farmers, and to exchange and share experiences on controlled-burning practices'. However, stricter zero-burning practices are adopted in the ASEAN Programme on Sustainable Management of Peatland Ecosystems 2014–2020 (APSMPE), which recommended a zero-burning practice with the use of controlled burning only in exceptional cases to prevent any uncontrolled wildfires on peatlands.[86]

In practice, however, Indigenous rights, as articulated under international law and the ASEAN Haze Agreement, are insufficiently respected and balanced against the goals for carbon emissions mitigation and a reduction in haze pollution. Conferences of the Parties of the UNFCCC, such as the 13th Bali COP, demonstrate that Indigenous voices and recommendations on climate change mitigation and adaptation – including Reducing Emissions from Deforestation and Forest Degradation (REDD) – and their concerns about further marginalization, have so far received little attention.[87] This points to a greater concern that Indigenous representation in sustainable peatland and forestry management has remained inadequate, with governments losing expertise and the ability to create informed policy. As this article discusses in Section 5, Indonesia's domestic implementation has focused on abating carbon emissions and transboundary haze pollution, without due consideration of the nuances presented by traditional uses of swidden agriculture.

The push towards deforestation prevention and climate change mitigation places swidden agriculture under pressure as a legitimate peatland management tool. International instruments – such as the UNFCCC, REDD, and regional ASEAN agreements – must recognize the nuance and role of traditional swidden agriculture and rotational agricultural practices, both as a cultural practice and as a tool to increase the resilience of local ecosystems. The use of fire and swidden agriculture as a legitimate land-use management technique, practised by Indigenous cultures, has received mixed responses in Indonesia. Although many academics and NGOs recognize the use of small-scale swidden agricultural methods as an effective biodiversity conservation technique,[88] this has not been translated well into Indonesian law or policy.[89] As the analysis below demonstrates, the blanket prohibition of the use of fire as a tool to manage agriculture significantly inhibits effective land and peatland management in Indonesia.

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[86] 23 Sept. 2013, available at: https://asean.org/speechandstatement/asean-haze-and-peatland-programmes.

[87] T. Griffiths, 'Seeing "REDD"? Forests, Climate Change Mitigation and the Rights of Indigenous Peoples and Local Communities', Forest People Programme, 3 Dec. 2008, pp. 1–53, at 4, available at: https://www.forestpeoples.org/sites/default/files/publication/2010/08/seeingreddupdatedraft3dec08eng.pdf.

[88] See, e.g., B. Finegan & R. Nasi, 'The Biodiversity and Conservation Potential of Swidden Agricultural Landscape', in G. Schroth et al. (eds), *Agroforestry and Biological Conservation in Tropical Landscapes* (Island Press, 2004), pp. 2–44, at 26.

[89] See F. Firatmaja, 'Gubenur Riau Tegas Melarang Buka Lahan Dengan Membakar', *Republika*, 15 July 2022, available at: https://www.republika.co.id/berita/rf1vhf418/gubernur-riau-tegas-melarang-buka-lahan-dengan-cara-dibakar.

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4.3. *Domestic Approaches to Haze Pollution: Law No. 32/2009 on Environmental Protection and Management*

At the national level, burning practices to open the land are prohibited under Article 69(1)(h) of Law No. 32/2009 on Environmental Protection and Management. However, the regulation recognizes traditional knowledge and practices in some regions, with Article 69(2) allowing traditional farmers to open the land up to a maximum of two hectares per household to plant local varieties and provide a firebreak around structures. While this is an important recognition of Indigenous rights, in practice, it is not being observed by law enforcement.[90] At the local level, local authorities prevent any burning practices for Indigenous people in their region, and there is limited recognition of Indigenous communities by law enforcement.[91] In addition, local authorities have suggested that allowing such practices would contradict national legislation (Article 69(h)).

Central Kalimantan and South Sumatra: Local regulations on traditional practices

At the local level in Central Kalimantan, traditional practices in opening land for burning had previously been recognized by Local Regulation No. 5/2003 on Land and Forest Fires Control. This recognition reflects that local governments aim to accommodate the interests of Indigenous people such as the Dayak communities, and recognize their traditional knowledge and practices in accordance with Article 69(2) of Law No. 32/2009 on Environmental Protection and Management. Dayak is a broad term which includes multiple ethnic groups that are Indigenous to the Island of Borneo. Borneo includes the Sultanate of Brunei, the East Malaysian states of Sabah and Sarawak, and Indonesian Kalimantan.

In practice, the accommodation of the interests of Indigenous communities, such as the Dayak, have been hampered by inconsistent land-clearing policies and legislation. For example, since 2010, local authorities have allowed both Indigenous people and local communities to burn peatland to clear land in Central Kalimantan under Governor Regulation No. 15/2010 and to further support the implementation of mega rice projects. The resulting influx of burning practices and the changes to the landscape in peatland areas required the local authorities to adopt new regulations, including Regulation No. 1/2020, which prohibited burning activities in peatland areas.

Dayak communities emphasize that they have employed traditional knowledge in land clearing through burning for generations. An interview with the Dayak community in Central Kalimantan highlighted that the local community has a technique for burning to prevent wildfires. However, local knowledge and practices that have been observed for generations have been degraded in some areas. The degradation of traditional knowledge and practices was explicitly addressed during an interview with a local NGO representative who identified that the younger generation of Dayak is not

[90] Firatmaja, n. 89 above.
[91] Ibid.

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familiar with the traditional terms and practices that have evolved through generations from their ancestors. In addition, the *Damang* is now an elected official employed by the government; such officials are therefore becoming removed from the communities that they serve. Recognition of traditional practices in local laws was abolished in 2016 when the government entered into a conservation project by Presidential Regulation No. 1/2016 on the Peatland Restoration Agency.

Unlike Central Kalimantan, and despite the existence of *adat* communities (primarily local and Indigenous communities who follow and enforce their customary law), South Sumatran regulations do not recognize such communities. The South Sumatran local authorities have banned burning practices for all communities through South Sumatra local Regulation No. 8/2016, thus applying a zero-burning policy.

5. DOMESTIC APPROACHES: PEATLAND RESTORATION AND ZERO-BURNING POLICY IN CENTRAL KALIMANTAN AND SOUTH SUMATRA

State intervention for peatland restoration is led by the Peatland Restoration Agency (BRG). While state-led approaches are important, there are also limitations to such approaches as the problem is complex and requires collaboration with stakeholders in addition to the state. Having examined the legal landscape across multiple scales, we now focus on two case studies in fire-prone regions of Indonesia where traditional burning and swidden agriculture occur: Central Kalimantan and South Sumatra. These case studies facilitate greater depth of understanding of the complex interaction of legal frameworks and state intervention in the context of swidden agriculture and traditional burning. This appreciation of the operation of the law and governance is then channelled into our recommendations in Section 6.

5.1. *Central Kalimantan*

Central Kalimantan has 3.01 million hectares of peatland and is very vulnerable to peatland fires. The area is one of seven priority regions for peatland restoration initiatives.[92] The highest frequency of land and forest fires occurs in Pulang Pisau, Kapuas, Katingan, and South Barito.[93] This research was conducted in Pulang Pisau Regency (Central Kalimantan) as this was the site of significant forest fires in the region. Peatland fires appear to be getting worse, particularly since the clearing of peatland for the one million-hectare MRP in 1995 by Presidential Decree No. 82/1995. Central Kalimantan is home to Dayak communities who practise swidden agriculture.

[92] W.S. Ritung et al., *Luas dan Kandungan Karbon di Kalimantan* [Map of Peatland Distribution Area and Carbon Content in Kalimantan] *2000–2002* (Wetland International – Indonesia Program & Wildlife Habitat Canada (WHC), 2004) available at: https://www.wetlands.or.id/PDF/buku/Atlas%20Sebaran%20Gambut%20Kalimantan.pdf.

[93] 'Memperkuat Kapasitas Masyarakat Kalteng untuk Menanggulangi Api', 27 Aug. 2012, available at: http://ditjenppi.menlhk.go.id/dari-media/311-memperkuat-kapasitas-masyarakat-kalteng-untuk-menanggulangi-api.html.

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State intervention in controlling land and forest fires through peatland restoration has had an impact on Indigenous practices in managing their peatland. The BRG has been given a mandate by the President to conduct restoration programmes in Central Kalimantan on 366,746 hectares of priority peatland restoration areas.[94] The difficulty of such restoration is that most peatland is located on cultivated land, which is either an area under corporate concession or a community's cultivation land. Strategies taken by the BRG are known as the 'Three R's': rewetting, revegetation, and revitalization of economic opportunities. Rewetting involves establishing infrastructure such as canal blocking, canal backfilling, and deep wells; revegetation includes the planting of endemic plants in peatland ecosystems, such as *jelutung*, *ramin*, blackboard trees, *meranti*, and agarwood; revitalization refers to alternative economic opportunities and livelihoods for the people.[95]

Several activities of peatland restoration, such as canal blocking and building deep wells, affect traditional practices in Dayak and local communities. Many canals (*handeel*) are used by locals to access their agricultural lands. In Central Kalimantan, for example, between 200 and 250 local communities use one *handeel*. Some of the canal blocking activities aimed at peatland restoration have blocked the transport system for locals who usually use small canals to access their farms. Therefore, prior informed consent needs to be a key component of restoration activities. Despite this, some institutions have stated that prior informed consent is not required prior to canal blocking, as the government owns these areas.[96] In contrast, the NGO Lestari emphasizes that prior informed consent is critical. It highlights that the canal dug for the MRP is, and has been, occupied by local communities.[97] Some canals that have been blocked have also created flooding and affected the community. Therefore, the informed consent of the community is needed in recognition of its use of the canal for its livelihood activities. The BRG should obtain prior informed consent from the community affected by these infrastructures, as required under Articles 19 and 32(2) UNDRIP.[98]

The revegetation programme also has an impact on traditional practices. Revegetation is successful only if it is planted on community *adat* land or in village forests. Our interviews highlighted that not all local communities who own peatland areas want their land to be planted with endemic species for timber products. Local communities in the Pulang Pisau Regency, for example, want to plant more cash crops than endemic species, which take a long time to harvest. Endemic local plants include *blangiran*, *jelutung*, and *galam*. Local people prefer to plant rubber and *sengon*, and have oil palm plantations, which can be harvested in short periods of five years,

[94] Media Center, 'BRG Restorasi 366.746 Ribu Hektar Lahan Gambut di Kalteng', *Palangkaraya go id*, 27 Dec. 2021, available at: https://palangkaraya.go.id/brg-restorasi-366-746-ribu-hektar-lahan-gambut-di-kalteng.

[95] 'Strategi 3 R dalam Upaya Restorasi Gambut', Badan Restorasi Gambut dan Mangrove (BRGM), available at: https://brgm.go.id/strategi-3r-dalam-upaya-restorasi-gambut/?lang=id.

[96] Interview with USAID Lestari, 10 Jan. 2019 (on file with the authors). USAID Lestari supports the Government of Indonesia in reducing greenhouse gas emissions and conserving biodiversity in carbon-rich and biologically significant forest and mangrove ecosystems.

[97] Ibid.

[98] N. 56 above.

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compared with endemic plants, which can take up to 20 years. In addition, with the establishment of the *sengon* factory in Central Kalimantan – ceremonially opened by President Joko Widodo – there is keen interest to plant *sengon* and sell *sengon* trees. However, *sengon* is not suitable for planting in deep peatland areas.

The traditional practices of some Dayak and local communities have shifted as a result of peatland restoration programmes and government laws and policies targeting swidden agriculture. The main concern of local people relates to food security. The banning of fires since 2016 has limited the production of rice for peoples' subsistence in some areas. Locals are concerned about the prohibition of burning practices in agriculture, with rice now bought rather than grown. For local and *adat* communities, having no rice farming also means a loss of identity and communal practices in gathering and helping each other in rice planting. Several non-burning methods have been introduced by the government to the local communities in peatland areas. These include new varieties of rice plants, and clearing the land without burning through methods such as the use of hand tractors, paludiculture (wet agriculture and forestry on peatlands), and acid wood (see Section 5.2). Some Indigenous people have adapted to the situation by changing their livelihoods and working in oil palm as labourers or selling endemic *galam* wood, which grows in peatlands. Some local communities are growing alternative crops such as *sengon* instead of existing plants such as rubber, oil palm, and vegetables. As a result, local people no longer have local rice farming in some areas, such as in Simpur Village, Central Kalimantan.

In addition, local communities in peatland areas in Central Kalimantan have not accepted the new variety of rice plant introduced by the government for cultural and economic reasons. Even though the new variety of rice has a short harvesting period of only three months, it is more costly and needs more intensive maintenance than local rice varieties, which require six to eight months of growth before harvesting. Local communities prefer to plant local rice varieties because of the taste of the rice and the low-cost maintenance. The communities can plant the local rice variety, leave it for four months to work outside their villages in gold mining in other regions, and then return to harvest the rice field.

The clearing of land without burning was initiated by the Ministry of Agriculture and facilitated by Indonesian military personnel and the BRG. The programme is part of opening 80,000 hectares of new rice fields for the country's food security programme.[99] Flattening the land and constructing rice fields is performed by heavy equipment, assisted by the military. However, in many cases, such as in Central Kalimantan, land-clearing programmes that do not involve burning have failed. Interviews with locals indicate that one to two years after the land was cleared and rice was planted there has been no harvest. Local communities stress that fires can add to the fertility of the land and kill pests. In addition, the introduction of hand tractors for local communities is very slow and difficult to implement because it is more costly to buy gasoline than to do the work manually. The low levels of formal education in communities is

[99] R. Widayati, 'Kementan Optimis Cetak 80.000 Hektar Sawah Baru', *Tempo*, 28 Apr. 2017, available at: https://bisnis.tempo.co/read/869870/kementan-optimis-cetak-80-000-hektar-sawah-baru.

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also an important factor because it hampers the uptake of technology and makes training in the use of such technology more difficult.

5.2. *South Sumatra*

The South Sumatra region is well known for its traditional *sonor* practices.[100] *Sonor* is a form of swidden agriculture in which locals use fire to clear rice fields and for other agriculture purposes in peatland areas. *Sonor* is a traditional form of rice cultivation practised during the dry season in peatland areas. This process involves waiting for wetlands to dry out. Once this has occurred, the surface vegetation burns easily. This allows rice seeds to be spread on the peat soil, which has been enriched from the ash of the burning process.[101] The communities then wait for the wet season to harvest the rice. This, too, requires attention to the level of inundation in the rice fields: farmers need to harvest the rice quickly so that this occurs before the fields are flooded and the crop spoilt. The practice of *sonor* is becoming more common with the increased incidence of droughts, new areas becoming accessible through canals, and migrants moving into the community also adopt the practice.[102] South Sumatra has 1.3 million hectares of peatland; it has been identified as a priority province for peatland restoration.[103]

This research was conducted in Ogan Komering Ilir, which has 1.03 million hectares of peatland.[104] Despite having been practised for generations and considered as part of the identity of local communities in South Sumatra, during an interview a local government official stated that *sonor* practices are destructive for the environment and have caused land and forest fires. Therefore, such practices have been prohibited. Like the Dayak communities in Central Kalimantan, local communities in Ogan Komering Ilir claimed that relations between the society and forests began to be disrupted when government policies granted permission to private entrepreneurs to use and exploit the forest resources on a large scale, including in peat swamp forests. This policy has serious consequences for local societies who surround forests and related Indigenous peoples whose livelihoods depend on natural forest resources as land for agricultural cultivation. It is also worth noting the particular deterioration of the condition of

[100] R.V. Utami, 'Budaya Sonor, Salah Satu Penyumbang Asap di Sumatra', *CNN Indonesia*, 8 Oct. 2015, available at: https://www.cnnindonesia.com/nasional/20151008032913-20-83589/budaya-sonor-salah-satu-penyumbang-asap-di-sumatra.

[101] U. Chokkalingam et al., 'Community Fire Use, Resource Change, and Livelihood Impacts: The Downward Spiral in the Wetlands of Southern Sumatra' (2007) 12(1) *Mitigation and Adaptation Strategies for Global Change*, pp. 75–100, at 75.

[102] F. Agus et al., 'Reducing Emissions from Peatland Deforestation and Degradation: Carbon Emission and Opportunity Costs', International Symposium and Workshop on Tropical Peatland, 'Carbon – Climate – Human Interaction: Carbon Pools, Fire, Mitigation, Restoration, and Wise Use', Yogyakarta (Indonesia), 27–31 Aug. 2007, available at: https://www.asb.cgiar.org/publication/reducing-emissions-peatland-deforestation-and-degradation-carbon-emission-and.

[103] Indonesian National Carbon Accounting System (INCAS), 'Sumatra Selatan', available at: http://incas.menlhk.go.id/id/data/south-sumatra.

[104] Press Release, 'OKI Susun Dokumen RPPEG, Lindungi 1,03 Juta Hektar Gambut', *Kaboki*, 15 Apr. 2022, available at: https://news.kaboki.go.id/index.php/press-release/oki-susun-dokumen-rppeg-lindungi-1-03-juta-hektar-gambut.html.

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peatland in South Sumatra in the 70% of peatland areas held by concession holders rather than the local community.[105]

Similar to Central Kalimantan, the peatland restoration project has had an impact on traditional practices. In South Sumatra, clearing the peatland for rice fields has also failed, with crops not growing as expected. The local community argues that without burning, rice plants might grow but they will not produce sufficient rice. Lack of irrigation infrastructure, problems in conducting surveys, and the poor design of local government investigations to determine suitable land for rice fields are the primary reasons for this failure. A soil expert from the Research and Development Agency (Balitbang) highlighted in an interview that deep peatland areas with high acid levels are not suitable for rice farming.

Alternative livelihoods have been introduced by Balitbang, the Ministry of Environment and Forestry, and the BRG to develop economically viable crops suitable for growing in wet peatland areas through paludiculture and agro-silvo fishery.[106] Paludiculture can be used for forestry and agroforestry in peatland areas. Examples of paludiculture include utilizing *purun* from the *purun* plant to produce handicrafts. However, many paludiculture projects are still at the pilot stage. The major challenge in scaling up paludiculture is that conventional agriculture machinery is usually unable to operate in wet or rewetted peatland.[107] Acid wood, introduced by the Ministry of Environment and Forestry, is one alternative to clearing the land without burning.[108] Wood that has been cut is collected in a bin and burned at a high temperature; a pipe collects the smoke, which becomes liquid acid. This acid vinegar can be used as a fertilizer. However, interview results show that a lack of market access hinders efforts to scale up the production of acid wood.

The case studies in the fire-prone areas of Indonesia highlight the complexity of sustainable and equitable peatland management in the country. Both the condition of the land and knowledge of traditional practices for sustaining land and people are deteriorating. This is exacerbated by large-scale projects in the name of food security and environmental protection. These projects are implemented in a top-down manner by powerful national government actors that promote corporate entities. As illustrated above, the active prohibition of traditional burning practices has had significant cultural, societal, and environmental impacts. The government has attempted to provide alternatives. However, as these alternatives are not valued by local communities and do not take into account place-based understanding of human and environmental

[105] T. Wijaya, 'Hampir 70 Persen Gambut di Sumatera Selatan Dikuasai Perusahaan. Masih Adakah untuk Masyarakat?', *Mongabay*, 11 June 2016, available at: https://www.mongabay.co.id/2016/06/11/hampir-70-persen-gambut-di-sumatera-selatan-dikuasai-perusahaan-masih-adakah-untuk-masyarakat.

[106] Interview with government official at Balitbang Kementerian Lingkungan Hidup dan Kehutanan (KLHK) [Ministry of Environment and Forestry], 19 Sept. 2019 (on file with the authors). KLHK, 'Agrosilvofishery Metode Jitu Pulihkan Ekosistem Gambut Terdegradasi', 8 Oct. 2018, available at: https://www.menlhk.go.id/site/single_post/1377.

[107] C. Schroder, 'Towards Large Scale Paludiculture: Addressing the Challenges of Biomass Harvesting in Wet and Rewetted Peatlands' (2015) 16(13) *Mires and Peat*, pp. 1–18, at 2.

[108] Interview, Balitbang KLHK, n. 106 above.

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needs, they have proved difficult to enforce, and have diminished cultural and societal cohesion, while limiting continuation of sustainable agriculture practices.

The case study findings underscore the important stake of local and Indigenous communities in maintaining traditional practices in the interests of maintaining culture, livelihoods, food security, and the environment. Yet, the state-based practices described above often do not sufficiently take into account local and Indigenous concerns, and fail to live up to the principle of prior informed consent. Thus, it is clear that what is needed is not only a more nuanced approach to understanding burning (as opposed to the blanket prohibition of all forms of burning), but also transnational legal and governance frameworks that bridge traditional practices, national policy, and transboundary concerns in a sustainable and equitable manner.

6. TOWARDS A TRANSNATIONAL APPROACH BRIDGING TRADITIONAL PRACTICES AND POLICY: SOCIAL EQUITY AND SUSTAINABLE PEATLAND MANAGEMENT

To address transboundary haze pollution and sustainable peatland management, there needs to be collaboration and cooperation between different stakeholders across multiple governance scales, with divergent interests representing a specific perspective on sustainable peatland management. Such an approach embraces divergent stakeholders for a more holistic and detailed account of the problems faced by peatlands, and an insight into how to mitigate them more effectively.[109] Unsurprisingly, a sectorial approach has proved ineffective in addressing the problems; therefore an integrated approach, which consolidates a variety of interests, must be pursued. Local communities are more likely to embrace governance surrounding peatland management when the strategies implemented are meaningfully co-produced not only with scientific stakeholders, but also with those who possess insights into traditional practices on the subject. Further, as demonstrated by the analysis above, law enforcement and local authorities do not sufficiently engage with traditional and Indigenous landholders who may have land and customary rights recognized by domestic and international law. The push for carbon abatement and reduction in transboundary haze pollution has resulted in a blanket prohibition of any fire activity in peatland environments.

Synergies between central and local government institutions are essential to address the haze pollution problem and achieve sustainable peatland management. There exist several institutions that have the capacity to assist in the effective management of peatland restoration. However, collaboration between these institutions presents its own challenges. These challenges include the conflict that can exist between the sectorial approach and turf wars that inhibit the ability for stakeholders to have open and respectful discussions. Further, a lack of coordination, funding, human resources, and technological innovation further prevent stakeholders from collaborating

[109] C.N. Service et al., 'Indigenous Knowledge and Science Unite to Reveal Spatial and Temporal Dimensions of Distributional Shift in Wildlife of Conservation Concern' (2014) 9(7) *PLoS One*, pp. 1–10, at 1.

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effectively, as these factors are all essential in ensuring the smooth functioning of these interactions. Therefore, governments should support cooperation between holders of traditional knowledge and scientists to explore the relationships between different knowledge systems and to foster interlinkages of mutual benefit.[110] In doing so, this increases the capacity for law enforcement and local authorities to better implement existing rules concerning peatland management; and to develop a more nuanced understanding that enables them to recognize the important role that traditional swidden agriculture plays in providing ecosystem services and cultural expression. Raising community awareness and improving the capacity and empowerment of the local community in providing alternative livelihoods and alternative burning practices in peatland areas is greatly needed.[111] Local people and farmers feel that they are economically disadvantaged from the implementation of the zero-burning policy.

6.1. *The Role of Academics and NGOs*

Academics and NGOs are important stakeholders in bridging the gap between legislation and traditional practices, and to assist in the implementation of peatland restoration programmes. Academics and research institutions – such as the University of Palangkaraya Research and Local Empowerment Unit (LPPM UPR), the Center for International Cooperation in Sustainable Management of Tropical Peatland (CIMTROP), and the Ministry of Environment and Forestry – have assisted local communities in developing capacity-building strategies.[112] They encourage empowerment through offering alternative means of livelihood, such as becoming a part of the rattan, fishery, cattle, ginger, or mushroom industry, or engaging in integrated peatland management with the agro-silvo fishery model.[113]

However, not all projects have been successful, in part because traditional farmers are unfamiliar with the new forms of livelihood that have been introduced and are therefore unwilling or unable to engage. Some NGOs – such as Lestari, funded by the US Agency for International Development (USAID) – have enabled communities to put forward a model and approach of prior informed consent in relation to canal blocking activities.[114] Similarly, Kemitraan, with international donor funding from REDD+ Norway, assists with a peatland awareness village (DPG) programme in 46 villages in Central Kalimantan.[115] These programmes have assisted local communities in managing peatland sustainably by establishing *perdes* (village regulations) on peatland restoration. Most of their *perdes* regulate the prevention and controlling of forest fires and natural resources management in their villages, such as *adat* forest, forest owned by

[110] UN Educational, Scientific and Cultural Organization (UNESCO), 'Declaration on Science and the Use of Scientific Knowledge and the Science Agenda: Framework for Action', Budapest (Hungary), 26 June–1 July 1999, available at: https://unesdoc.unesco.org/ark:/48223/pf0000116994.

[111] Alam & Nurhidayah, n. 12 above.

[112] Interview with academics from LLPM UPR, Aug. 2019 (on file with the authors).

[113] Ibid.

[114] Interview, USAID Lestari, n. 96 above.

[115] Interview with NGO Kemitraan, Aug. 2019 (on file with the authors).

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villages, and river management. The problem of implementation of the *perdes* lies in the need to monitor their effectiveness. The BRG has a target to establish 1,000 peatland awareness villages with 300 villages facilitated using state budget, 200 villages facilitated by NGOs and donors, and 500 villages facilitated by companies/private concessions. In addition, the private sector must contribute to assist with market access to sustainable peatland crops. For example, the BRG has recently collaborated with online shopping platform, Bukalapak, to sell products resulting from peatlands, such as rice and other food products.[116]

The concern of the current restoration programme is its continuation and whether the programme is actually transforming and strengthening institutional frameworks at the local community level. This transformation is a significant task for the Peatland and Mangrove Restoration Agency (BRGM). Despite this timeline, in an interview with the Peatland Restoration Team at the local level (TRGD), missing linkages in the current funding target of the programme and continuation of the project in the future were identified. Successful rewetting involves scientific understanding that is appropriate for socio-economic conditions and an undertaking of cooperative initiatives among Indigenous communities.[117] In addition, the current revitalization programme is only a pilot, requiring huge efforts and funds to replicate and upscale the programme to other areas and locations.

6.2. *Transnational Collaboration across Scales and Government Institutions*

Increased prosecutions of corporations for forest clearing offences are an important step towards reducing the incidence of land and forest fires. Since its establishment, the Gakkum (Special Directorate in charge of law enforcement in the Ministry of the Environment and Forestry since 2015) has won a number of court cases against businesses; these include PT Waringin Argo Jaya,[118] PT Merbau Pelalawan Lestari,[119] PT Bumi Mekar Hijau,[120] and PT Nasional Sago Prima.[121] However, in none of the cases has a company paid a fine. The failure of the Indonesian government to prosecute corporations prior to the establishment of Gakkum led the Singapore government to enact the Transboundary Haze Pollution Act 2014. This Act allows the Singapore government to take action against entities (corporations) outside Singapore that cause or

[116] BRG Indonesia, 'Siaran Pers Penandatanganan Mou Antara Brg Dengan Bukalapak dan BRG dengan MUI', 18 Dec. 2019, available at: https://brg.go.id/siaranpers/siaran-pers-penandatanganan-mou-antara-brg-dengan-bukalapak-dan-brg-dengan-mui.

[117] Page et al., n. 42 above.

[118] In 2017, the company was found to have deliberately lit a fire to clear land in South Sumatra province, leading to a forest fire. WAJ was ordered to pay a fine of rupiah (Rp) 466.5 billion (approximately US$35 million).

[119] In 2016, the Supreme Court found the Indonesian logging company guilty of conducting illegal logging and ordered the company to pay a US$1.2 billion fine for unlawfully clearing 5,500 protected trees and 1,873 hectares outside the concession areas.

[120] In Aug. 2016, the High Court in Palembang, South Sumatra found PT Bumi Mekar Hijau, a pulpwood company, guilty of burning its concession area for land clearing and ordered it to pay US$5 million in damages.

[121] The Jakarta District Court ordered a sago plantation firm, PT National Sago Prima, to pay a US$76 million fine for failing to stop fire in its concession area.

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contribute to any domestic haze pollution.[122] Meanwhile, Article 69(h) of Law No. 32/2009 on Environmental Protection and Management prohibits the opening of land by burning.[123] Penalties include three years' imprisonment and fines of up to 3 million rupiah (Rp).

There are multiple governmental ministries and agencies that play a role in peatland management, including national line ministries.[124] Accordingly, the role of ensuring sustainable peatland management is compartmentalized and divided up between government institutions. This approach to peatland management is not favourable for two reasons. Firstly, as we demonstrate in this article, the issue of sustainable and equitable peatland management is complex and multifaceted. There is therefore a need for holistic and integrated multi-scale governance approaches. Accordingly, dividing the management of interconnected social-ecological systems into different institutions does not reflect the way in which either the environment or society functions.

Secondly, a fragmented approach to the management of peatlands creates issues in relation to effective communication. If each institution does not collaborate with the other institutions, a holistic approach to peatland management cannot be achieved, as there is no engagement between the institutions to make determinations about the practices they should utilize. The BRG is a focal point for peatland restoration since the enactment of Presidential Regulation No. 1/2016 on the Peatland Restoration Agency (BRG), which was extended to 2024 with Presidential Regulation No. 120/2020 on the Peatland and Mangrove Restoration Agency (BRGM). The BRG worked for five years, from 2016 to 2020, to restore 2 million hectares of peatland.[125] The restoration is not only to restore the peatland ecosystem but, most importantly, to revitalize the livelihoods of local communities by cultivating peatland areas. To achieve successful restoration projects, the BRG works with local communities and villages. The establishment of 1,000 peatland awareness villages in four years from 2,954 villages located around 12.7 million hectares of peatland areas is an ambitious programme.[126] A significant challenge in implementing the programme is the effective implementation of the 3R projects (rewetting, revegetation, and revitalization). This is especially the case regarding the revitalization programme and the continuation and maintenance of the project past the 2020 end-date of the BRG work. Continuation of the restoration programme will require strengthening the collaboration between the Ministry of Environment and Forestry and the BRGM.

The community participation model in the restoration projects needs to be reviewed to improve the sustainability of these projects. The current model only benefits some

[122] L. Nurhidayah, S. Alam & Z. Lipman, 'The Influence of International Law upon ASEAN Approaches in Addressing Transboundary Haze Pollution in Southeast Asia' (2015) 37(2) *Contemporary Southeast Asia*, pp. 183–210, at 183; L. Nurhidayah, Z. Lipman & S. Alam, 'REDD+ and Forest Fires: Implications for the Legal and Policy Forest Fire Management Framework in Indonesia' (2017) 34(3) *Environmental Planning Law Journal*, pp. 251–67, at 251.

[123] N. 90 above.

[124] Miller, n. 24 above.

[125] Presidential Regulation No. 1/2016 on the Peatland Restoration Agency (BRG), Art. 4.

[126] B.P. Siregar, 'BRG Targetkan 1000 Desa Peduli Gambut Terbentuk', *Warta Ekonomi*, 13 Mar. 2017, available at: https://wartaekonomi.co.id/read133758/brg-targetkan-1000-desa-peduli-gambut-terbentuk.

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locals and not whole groups in the community, particularly in relation to the economic incentive for initiating revitalization programmes. The BRG cannot work alone as it needs cooperation and collaboration with other ministries, such as the Ministry of Trade, to achieve market access for new alternative crops or livelihoods. The National Disaster Management Agency (BNPB) is one user of deep wells in the case of forest fire suppression. Unfortunately, this collaboration has not yet been significantly established. To resolve the conflict of land tenure ownership, the BRG also needs to cooperate and collaborate with various agencies at the central and local levels – such as the Ministry of Environment and Forestry, the Ministry of Agrarian and Spatial Planning/National Land Agency (ATR/BPN), and the dispute settlement task force at the local level.

The role of the Ministry of Environment and Forestry, particularly in advancing local community engagement in peatland restoration, is undertaken by the *litbang* (research and development) unit. It has an important role to play in introducing a method of paludiculture and acid wood. It is important to introduce modern technology which can be trusted by local communities in the implementation of alternative livelihoods, such as the introduction of plants that can be grown in peatland areas. In addition, the Ministry of Environment and Forestry plays an integral role in managing the peatland. Several regulations have been enacted by the Ministry of Environment and Forestry to restore peatlands, none of which, however, mention traditional knowledge and practices. These include:

- Regulation No. P.14/2017 on Procedures for Inventory and Determination of Peat Ecosystem Function;
- Regulation No. P.15/2017 on Procedures on Water Table Measurement on Peat Ecosystem Compliance Point;
- Regulation No. P.16/2017 on Technical Guidance Restoration of Peat Ecosystem Function; and
- Regulation No. 17/2017 on the Change of Regulation No. P.12/2015 on Development of Industrial Plantation Plants (HTI).

Furthermore, the Ministry of Agriculture plays an important role in implementing the food security programme under the Joko Widodo administration.[127] This programme includes introducing new advanced varieties of rice, intensification and capacity building to communities, and opening new rice fields. The new opening of a rice field (or *cetak sawah*), which is currently under way in several provinces in Indonesia, should be undertaken in cooperation and collaboration with different institutions. The BRG and the Ministry of Agriculture should cooperate particularly in deciding which peatland areas are suitable for agriculture, as the failure to establish this programme

[127] Kementerian Pertanian [Ministry of Agriculture], 'Dampingi Presiden Jokowi di Kalteng, Mentan SYL Siap Percepat Bangun Food Estate', 9 July 2020, available at: https://www.pertanian.go.id/home/?show=news&act=view&id=4443#:~:text=Food%20estate%20merupakan%20salah%20satu,percontohan%20penerapan%20teknologi%20pertanian%204.0.

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effectively results in land clearing that is not suitable for rice fields, such as in deep peatland areas. The characteristics of the land in peatland and non-peatland areas should also be considered, as some of the *cetak sawah* in peatland areas has failed to harvest. Although *cetak sawah* has been successful in some areas, this should not be seen as a guarantee that it will be a successful model in other places.

Local government also plays an important role in regulating fire prevention and control under local government regulation. In Central Kalimantan, for example, the local government has accommodated the voices of local communities who demand an allowance to conduct controlled burning. In addition, the local government has committed to improving the welfare and food security of local communities, as well as recognizing its duty to prevent and control forest fires under local regulation. Under a decentralized model, local government plays an important role in managing natural resources. However, under the programme of recentralization initiated by Law No. 23/2014, local governments, particularly at the municipal and district levels, no longer have the authority to manage forests. The restoration programme conducted by the BRG in the early stages seems to have excluded the municipal and district levels in restoration engagement. The TRGD – the regional team of the BRG at the local level as mandated by Presidential Regulation No. 1/2016 on the Peatland Restoration Agency – lacks the power and authority to engage in restoration directly as it has authority only to coordinate other agencies. In the second and third years of the BRG, the TRGD was vested with additional powers to implement the restoration programme.

Finally, there is an opportunity to improve compliance with international and regional obligations relating to swidden agriculture and Indigenous forestry practices, in particular the obligations as set out under the UNDRIP[128] and the CBD.[129] This requires significant reform by state and non-state actors. For the Indonesian government, there is an urgent need to establish a land dispute resolution mechanism, or other independent commission, which can enable Indigenous communities to seek redress where legislation or projects have been initiated without the free, prior and informed consent of community members. To ensure adequate access to justice, this mechanism must not only be able to investigate complaints where the ability for Indigenous communities to exercise their traditional cultural and economic rights has been infringed, but also must have minimal cost burdens and alternative dispute resolution mechanisms available to enable effective redress. To date, existing mechanisms are too burdensome for Indigenous communities to engage in constitutional and judicial review, and no judicial process exists which has a specific mandate and expertise to enforce and realize Indigenous rights recognized under international and regional agreements.

Improving compliance to empower Indigenous communities to exercise their cultural traditions and customs also requires the action of non-state actors, including multinational corporations (such as palm oil plantations and concession holders) and foreign aid donors. These actors play a vital role in contributing to haze pollution,

[128] N. 56 above.
[129] N. 15 above.

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which is the target of many zero-burning policies, and are often in direct conflict with traditional landholders. Increased transparency in the palm oil supply chains, and including the active, informed participation of Indigenous communities in the sustainable certification process, are vital. Including the voices of Indigenous communities in sustainability certification prevents 'greenwashing' and enables certifiers to distinguish between traditional cultural practices and large-scale, commercial slash-and-burn practices, which contribute predominantly to transboundary haze pollution. Greater supply chain transparency must also be supplemented with mandatory grievance policies, which enable fair compensation for local Indigenous communities that aligns with the UNDRIP and CBD, and with donor institutions, investors, and non-government actors playing a key role in policing and demanding minimum human rights standards for Indigenous communities. Through a transnational lens, collaboration across scales and government institutions is the key to successful transition from burning practices in peatland to non-burning practices and upholding social equity and sustainability.

7. CONCLUSION

This article demonstrates that a more nuanced conversation surrounding the use of fire and swidden agriculture in peatlands is needed. Swidden agriculture plays an important role in biodiversity management and has extensive roots in cultural expression for Indigenous communities. The issue here is one of scale. Although swidden agriculture remains an appropriate tool for small-scale farmers, the extensive use of burning alone to propagate large-scale monoculture (palm oil production, for example, or other timber products) devastates local biomes and creates widespread haze pollution. The latter approach largely fails to take into account the place-based cultural knowledge of traditional swidden practices, such as the type of vegetation, timing of burning, and fallow periods. The scale of monoculture requires an extensive fallow period for soils to recover. Further, the indiscriminate use of fire in disturbed landscapes means that fires are also more prone to spread uncontrollably.

It is essential that initiatives aimed at achieving sustainable peatland management focus on pursuing a multi-disciplinary and multi-stakeholder approach that fosters respect for, and consideration of, traditional knowledge and practices. This can be achieved by providing more support, such as social safety nets, micro credits, and capacity-building for the local community. To achieve this, it is essential that there is a shift from burning practices to non-burning practices; however, this is not always easy. Burning practices have proven effective in growing local rice, and such practices have been undertaken over generations. While some locals can adapt to this banning of fires by pursuing alternative livelihoods, some will struggle to adapt; therefore, land and forest fires will continue. Continued support for establishing alternative livelihoods based on local knowledge, practices, and experiences is needed to empower the local community to ensure sustainable peatland management. Moreover, to foster support for a multi-stakeholder platform, there is a need to bridge the gap between traditional knowledge and practices and technological innovation to discover safer and more effective burning methods.

The current sectorial legislation is hindering the implementation of an effective response to achieve sustainable peatland management. A mapping of the relevant stakeholders provides evidence that there is a wide range of important perspectives that, if combined through effective collaboration, could result in a detailed and holistic approach to peatland management that is informed by both technological and experiential understanding. Therefore, there needs to be robust legal reform that supports a multi-stakeholder platform in addressing land and forest fires. Currently, many abandoned private peatland areas are at high risk of causing fires in the dry season. Policy reform is needed to provide a partnership between the government and local landowners of peatland areas. This partnership should aim to incentivize locals to support the innovation of sustainable peatland management and to restore their private peatland areas to prevent further degradation, which can cause forest fires.

The commitment of the Indonesian government to reduce transboundary haze pollution has forced local governments to suppress the burning practices of local communities for agricultural purposes, which have been practised since the time of their ancestors. Technology that has been introduced has not been fully accepted and trusted by local communities, which has led to the current stasis. There should be collaboration and cooperation between traditional knowledge holders and scientists. Our interviews show that local communities indicate that the suppression of their burning practices violates their human rights to meet their needs and food security. More robust innovation and capacity building, as well as help in microfinancing to improve the livelihoods of local communities through the introduction of holistic alternative livelihoods, are important measures for bridging issues of equity and sustainability. This would require not only improving the skills and capacity of local communities but also helping to improve market access. However, more fundamentally, there is the need for platforms and fora where Indigenous knowledge and traditional practices are valued and considered in tandem with 'modern' solutions.

Synergy and collaboration from global to local scales and between diverse stakeholders, institutions, regulatory instruments, and legal frameworks are key to sustainable peatland management. The current challenges are lack of coordination across different institutions and regulatory layers. Every institution is currently aiming to achieve its own goal rather than communicating and collaborating with other government institutions to achieve broader sustainable peatland management. A further challenge is the lack of appreciation and recognition of the critical contributions that Indigenous and local communities and traditional practices can make to equity and sustainability in the face of global environmental change. A transnational, multi-disciplinary, and multi-stakeholder approach, which centres traditional knowledge and practices, is needed to achieve sustainable peatland management in Indonesia. The partnership between the government as well as local landowners and communities of peatland areas needs to be improved while linking to global drivers of peatland degradation. This partnership should aim to provide incentives for locals to restore their private peatland areas and prevent further degradation of peatlands, which can cause forest fires.